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The Forest Research Institute,
Dehra Dun
Triennial Programme of Work
1933-36 and 1936-39

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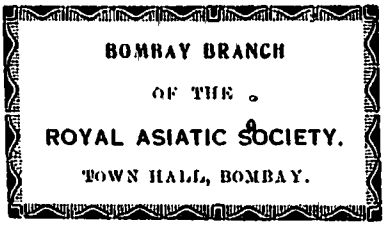

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TRIENNIAL PROGRAMME OF WORK

FOR

134402

THE FOREST RESEARCH INSTITUTE, DEHRA DUN,

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC

FOR

1933-36

& 1936-39

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CALCUTTA
GOVERNMENT OF INDIA PRESS
1933

BOMBAY BRANCH
OF THE
ROYAL ASIATIC SOCIETY.
TOWN HALL, BOMBAY.

TRIENNIAL PROGRAMME OF WORK

FOR

THE FOREST RESEARCH INSTITUTE, DEHRA DUN,

FOR

1933-36

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

CALCUTTA
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1933

Triennial Programme of Work for the Forest Research Institute,

1933-36.

(The numbers printed in bold type represent the numbers of projects.)

SILVICULTURAL BRANCH.

I.—ROUTINE WORK.

1. (*a*) *Ledger Files.*—Maintenance of specific and general ledger files collecting all information available from publications, tour notes, etc. The photographic collections are included in this work.

(*b*) *Provincial Experimental Plot Files.*—Scrutiny and record of all provincial Experimental Plot files.

(*c*) *Provincial Sample Plot Files.*—Scrutiny, computation and record of all provincial Sample Plot files.

(*d*) *Touring.*—Inspection of representative Experimental and Statistical plots and silvicultural problems in the provinces as occasion demands and circumstances allow.

(*e*) *Improvements of Research Technique.*—Investigation of promising suggestions for improvements of research technique under Indian conditions, wherever opportunities exist.

II.—COMPILATION FOR PUBLICATION.

2. *Publications* on—

(*a*) *Selected General Subjects*—

1. Forest types of India.
2. Cover crops in forestry.
3. Thinnings.
4. Forest grazing.
5. Regeneration of evergreen forests.
6. Mixture of species.
7. Root Competition.

(*b*) *Selected Species*—

1. *Shorea robusta* (primarily regeneration methods).
2. *Tectona grandis.*
3. *Cedrus deodara.*
4. Possibly *Bombax, Gmelina, Pinus excelsa,* and *Terminalia myriocarpa.*

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III.—EXPERIMENTAL SILVICULTURE.

(i) Seed Investigations.

3. Determination of seed weights, germination and plant percents. To be done for all species of importance.

4. *Seed Storage.*—To be continued for important species.

5. *Aids to Germination.*—To be undertaken for species with which difficulty is experienced in the provinces.

(ii) Seedling Investigations.

6. *Artificial Regeneration Methods* to be investigated for important species not yet dealt with fully :—

Ougeinia, Michelia, Cinnamomum, etc.

7. *Root Systems* to be studied where special information needed as for *sal* natural regeneration.

(iii) Tree and Crop Investigations.

8. *Seed Origin Problems.*—Investigations to be continued for the chief species used in plantations and for the special problems of :—

(1) Spiral grain in *chir* pine, etc.
(2) Figured wood in *Terminalia tomentosa, Chickrassia,* etc.
(3) Heartwood and oil in sandalwood.
(4) Solid culms in bamboo.

9. *Phenological Data.*—Collection of records to be continued on suitable and important trees.

(iv) Management Problems.

10. *Rotation, etc., of Bamboo.*—Co-operative investigation in interested provinces, inspection of experiments and some help in laying them out would be required (*Melocanna* problems should be included).

11. *Grazing Combined with Forestry.*—Co-operative investigation in interested provinces, inspection of experiments and some help in laying them out would be required.

(v) Protection Problems.

12. *Erosion.*—Co-operation with provinces if they undertake investigations (Silvicultural Conference, 1929. Item 21).

13. *Forest Grazing.*—Co-operation with provinces if they undertake investigations (Silvicultural Conference, 1929. Item 20).

14. *Congestion in Bamboo.* Causes to be studied experimentally

15. *Spiral Grain in Chir Pine.*—Causes to be studied experimentally.

(vi) PHYSIOLOGICAL PROBLEMS.

16. *Root Competition.*—Nothing is definitely known for Indian conditions.

(vii) SOIL PROBLEMS.

17. *Effect of Forest-Cover on the Soil* and recognition of soil conditions.

18. *Effect of Afforestation on Soil.*—Existing investigation to be continued but analyses not required till 1937.

19. *Cover Crops.*—Investigations to be continued in co-operation with Biochemist with likely species.

20. *Effect of Burning on Soil* conditions and cover.

IV.—STATISTICAL.

21. *Yield Tables.*—Revision of the 1923 *sal* yield table with addition of assortment tables and form quotient data. Thinning grades to be differentiated if possible. Standard tables for teak have not yet been prepared and could be put in hand if time allows.

22. *Sample Plot Work.*—Continental developments of technique to be studied for their applicability to Indian conditions particularly for use of standing sample trees. *Cf.* Silvicultural Conference, 1929, Resolution 14 (6).

23. *Volume Tables.*—Co-operation with provinces in carrying out Silvicultural Conference, 1929, Resolution 13, or making tables for listed species. *Dalbergia sissoo* and *Terminalia tomentosa* offer best prospects for early completion.

24. *Statistics for Irregular Crops.*—Detailed investigation of all promising methods aiming at recommendations for working plan field work will be taken up. Value and application of stump analysis data. *Cf.* Silvicultural Conference, 1929, Resolution 11 (*c*) and 11 (*b*).

25. *Thinnings, etc.*—

(*a*) Field studies to give provisional data for use pending results from comparative sample plots. *Cf.* Silvicultural Conference, 1929, Resolution 14.

(*b*) Effect of incomplete stocking on increment.

26. *Loss of Increment from Defoliation.*—In collaboration with Forest Entomologist and provinces with some experimental work at Dehra Dun.

BOTANICAL BRANCH.

FOREST BOTANY.

1. *Study of Important Forest Grasses.*—Further trials will be made with a view to establishing suitable perennial fodder grasses to keep down local coarse grasses. Observations relating to the two grasses, *Amphilophis* and *Cymbopogon*, which are being grown for systematic study, will be continued.

2. *Completion of Duthie's Flora of the Upper Gangetic Plain.*—This work is in Mr. R. N. Parker's hands and will be continued by him.

3. *Forest Plants.*—Illustrations and descriptions of Indian forest plants imperfectly known, overlooked and confused hitherto. Further material and literature will be examined and dealt with.

4. *Dipterocarpaceae.*—Study of the species of *Dipterocarpaceae* belonging to the genera *Shorea*, *Hopea* and *Anisoptera*, in India and Burma. Further material and literature will be examined and dealt with.

5. *Terminalias.*—Study of the Indian and Burmese species of *Terminalia*. Further material and literature will be examined and dealt with.

6. *Bambusaceae.*—Studies relating to the *Bambusaceae* of India and Burma. Further material and literature will be examined and dealt with.

7. *Arboretum.*—Establishment of an arboretum at the Forest Research Institute at Dehra Dun.

Further trials with suitable plants and planting will be done. Observations relating to the study of root-nodule organisms will be continued and, if necessary, further inoculations will be made.

8. *Summarising of Botanical Science.*—Annual summarising of the most important developments of botanical science in India especially relating to forestry. As suggested by the Chief Conservator of Forests, Central Provinces, a note will be issued annually.

MYCOLOGY.

9. *Root Disease of Shisham.*—Further inoculations with *Fusarium* will be done together with joint inoculations with *Polyporus gilvus* and *Ganoderma lucidum* and observations made.

10. *Die-Back Disease of Gmelina arborea.*—Cultural studies and observations will be continued.

11. *Peridermium spp. in India*—

(*a*) *P. himalayense.*—Observations will be continued on the inoculations of *Pinus longifolia* with sporidia from *Swertia* spp.

(*b*) *P. indicum.*—Cross inoculations with the aecidial and teleuto stages of *Pinus excelsa* and *Ribes rubrum* will be made and observed.

(*c*) *P. complanatum.*—Investigations to discover the alternate stage of this organism and inoculations from alternate hosts will be made.

(*d*) *P. cedri.*—Investigations to discover the alternate stage of this organism and inoculations from alternate hosts will be made.

12. *Damping-off of Forest Seedlings.*—Further experiments will be continued with seed sown in different soil compositions with the object of naturally controlling the disease-causing organisms.

13. *Cultural Studies of Wood-Rotting Fungi.*—Inoculations of suitable hardwoods with wood-rotting pathogenes will be made and observed.

14. *Sal Root Diseases including Polyporus shoreae.*

ENTOMOLOGICAL BRANCH.

A.—BIOLOGY AND CONTROL.

I.—Insects of Sal (*Shorea robusta*).

Borers. *Hoplocerambyx spinicornis, Aeolesthes holosericea, Diorthus simplex, Gerontha captiosella, Xyleborus, Diapus, Platypus, Crossotarsus*, etc.

1. Publication of a general guide to the borers of *sal*, their biology, means of recognising the insects and the damage done, the preventive and remedial measures in theory and practice.

2. The relative importance of borers, and other factors such as root and bark diseases, fires, drought, etc., in the dying-off of *sal*.

3. Advice on future outbreaks of borers, and dying-off as and when required with local investigation by field-parties.

II.—Insects of Teak (*Tectona grandis*).

Borers.

4. Conclusion of biology of teak canker grub (*Dihammus cervinus*) and publication of results.

5. Study of the biology of the *Phassus* borer (*Phassus malabaricus*) in teak plantations and in other trees attacked by it, notably *Eucalyptus robusta* in Coorg, and *Cryptomeria* in Bengal.

Defoliators.—*Hapalia machaeralis, Hyblaea puera*, and associated caterpillar and beetle defoliators.

6. Conclusion of biology of teak defoliators in India and publication of results.

7. Study of the ecological factors influencing the incidence of defoliation in Nilambur plantations in collaboration with the Madras Forest Department.

8. Study of the loss of increment due to defoliation in collaboration with Central Silviculturist.

III.—Insects of Sandal (*Santalum album*).

9. Survey of the insect fauna of sandal and associated host trees, life-histories of the commoner species and suspected vectors of spike disease, transmission experiments, etc., etc., in accordance with the programme approved by the Sandal Spike Conference and the Research Control Board.

10. Publication of results of life-history studies, transmission experiments, and faunistic surveys of sample plots and observation areas. (*See* also Systematic Entomology No. 44.)

IV.—Insects of *Acrocarpus fraxinifolius*.

Borers. *Xyleborus* sp., *Pyralid* sp. and Defoliators, *Terias silhetana*.

11. Life-histories of the borers and defoliators, especially of young plants.

V.—Insects of Bamboo (*Dendrocalamus strictus*).

Borers.

12. Conclusion of life-history studies of borers of felled bamboo, and their control, and publication of results (*Dinoderus brevis, minutus* and *occellaris, Heterobostrychus aequalis, parallela*, etc.).

13. Life-histories of borers of living bamboo. (*Cyrrotrachelus longipes, Estigmena chinensis*, etc.).

Defoliators.

14. Conclusion of life-history studies of *Pyrausta coclesalis* and other leaf rollers and defoliators.

VI.—Insects of Champ (*Michelia champaca*).

15. Investigation of the dying-back of *champ* plantations and the insects associated with it (*Urostylis punctigera*, Aphids, etc.).

VII.—Nursery and Transplant Pests of Deodar (*Cedrus deodara*).

16. Investigation of the dying-off of deodar seedlings and transplants and the insects associated with it.

VIII.—Insects of *Duabanga sonneratioides*.

17. Investigation of the dying-back of *lampatti* and the insects associated with it.

IX.—Insects of Farash (*Tamarix articulata*).

18. Investigation of damage by termites to *farash* cuttings.

X.—Insects of Gamari (*Gmelina arborea*).

Borers.

19. Conclusion of life-history studies of shoot borer (*Alcides gmelinae*) and publication of results.

Defoliators.

20. Conclusion of life-history studies of defoliators and publication of results (*Calopepla leayana*, Tingid, etc.).

21. Investigation of life-histories of parasites of *Calopepla leayana* *see* item No. 31).

XI.—Insects of Hollock (*Terminalia myriocarpa*).

22. Investigation of dying-back of *hollock* plantations and the insects associated with it.

XII.—Insects of Mahogany (*Swietenia mahagoni*).

23. Investigation of the shoot borer of mahogany (*Hypsipyla robusta*) and other pests of the tree in plantations.

XIII.—Insects of Mulberry (*Morus indica*).

24. Investigation of the life-history of *Glyphodes pyolalis* and other defoliators of the tree in plantations.

XIV.—Insects of Oak (*Quercus dilatata* and *Quercus incana*).

25. Conclusion of investigation of the defoliation of oaks in Muktesar Laboratory Forests, United Provinces.

XV.—Insects of Shisham (*Dalbergia sissoo*).

26. Publication of biology of defoliators of *shisham* and the factors of biological, direct and silvicultural control in irrigated plantations (*Plecoptera reflexa, Dichomeris eridantis*).

XVI.—Borers of Indian Timbers.

27. Continuation of the general survey of the borer fauna of the principal timber species of British India, and of the alternate food-plants of these borers.

28. Publication of notes on the life-histories, distribution, food-plants, etc., in serial parts by families.

29. Survey of the distribution and foodplants of indigenous lyctids (powderpost beetles) with special reference to mills, depots and ports dealing with timber exported from India, in collaboration with the Forest Products Laboratory, Princes Risborough.

30. Investigation of measures for the protection of timber in the log, and converted timber from damage by lyctids, shothole and pinhole borers, longhorn borers, etc.

XVII.—Parasites and Predators.

31. Life-histories and distribution and alternate hosts of parasites and predators of defoliators of teak, sandal, bamboo, *gamari*, mulberry, oak, *shisham*, etc., in conjunction with items 1, 3, 5, 10, 13, 14, 16, and of borers of *sal*, teak, bamboo, mahogany and other timbers in conjunction with items 1, 2, 5, 12, and 17.

32. Publication of life-history notes in serial parts by families.

XVIII.—Termites.

33. Conclusion of investigations on the seasonal incidence of soil termites in Dehra Dun and methods of testing the liability of timbers to attack by soil termites, and of testing the relative efficiency of preservatives and publication of results, in collaboration with the Wood Preservation Section.

XIX.—General Economic Entomology.

34. Maintenance of a card catalogue to economic entomological and zoological literature of the world.

35. Maintenance of a card catalogue of the insect pests of trees and the foodplants of forest insects, and the parasites and predators of forest insects.

36. Preparation of a reference work on Indian forest insects and methods of pest control.

37. Preparation of an elementary text book of forest entomology.

B.—SYSTEMATICS.

XX.—Identification.

38. Identification at Dehra Dun of insects sent in by forest departments, or collected by touring parties, or bred in the insectary.

39. Distribution of material to collaborating specialists throughout the world.

XXI.—Taxonomy.

40. Description of early stages of pest species and their allies and associates with particular reference to wood boring larvae and soil insects (nursery pests).

41. Publication of further contributions to the series 'Immature Stages of Indian Coleoptera'.

42. Revision of the Indian *Cerambycidae*.

43. Revision of the oriental *Scolytidae* and *Platypodidae*.

44. Publication of the data of the sandal insect survey in the series 'Entomological Investigations of the Spike Disease of Sandal'.

45. Publication of systematic papers by specialists in Indian Forest Records and in foreign periodicals.

46. Maintenance of a card index of newly described Indian species and keeping up to date of published catalogues.

ECONOMIC BRANCH.

MINOR FOREST PRODUCTS SECTION.

Special Inquiries.

1. *Match Splints and Box Veneers.*—To continue to test such species as come to hand for suitability for the manufacture of match splints and box veneers, in co-operation with the Western India Match Co., and to collect and record all information received from match manufacturers as regards the suitability of the species used by them.

2. *Portable Charcoal Kiln.*—To continue the investigation on the "life" of the Forest Research Institute portable charcoal kiln, by doing as many burnings as possible as and when opportunities occur.

3. *Briquetting.*—To continue experiments with the ovoid briquetting press, using *Bauhinia retusa* gum, powdered rice, maize, *jaa*, *jowar*, and *ragi* as binders.

Routine Work.

4. *Inventory of Minor Forest Products in Industry.*—Surveying and making an inventory of all industries dependent wholly or in part on minor forest products. This is part of the ordinary routine work of the Section. All information collected is recorded in the Permanent Record files.

5. *Minor Forest Products.*—Enquiring into the collection, cropping, outturn, value, and marketing of minor forest products under the following heads :—

(1) Fibres.

(2) Flosses.

(3) Oil seeds.

(4) Essential oils from grasses, etc.

(5) Gums, resins, oleo-resins, wood oils, and natural varnishes.

(6) Drugs and spices.

(7) Canes, rushes and bamboos (other than for paper making).

6. *Minor Forest Products Garden.*—Enlarging and planting up the Minor Forest Products garden, in order to have as complete a collection as possible of economic forest plants.

WOOD TECHNOLOGY SECTION.

Special Inquiries.

7. *Keys for the Identification of Commercial Woods.*—The preparation of keys supplemented with X 10 photomicrographs for the identification of important commercial woods, for each province.

Keys for Assam, United Provinces, and Madras will probably be taken up during the triennium.

8. *Woods of the Dipterocarpaceæ.*—To study the woods of the *Dipterocarpaceæ* with a view to finding a means of separating the species.

9. *Shrinkage of Wood.*—To investigate the causes of differences in shrinkage of wood from different parts of a tree. Work has already been started with *Cedrela toona.*

10. *Growth Rings.*—To continue the study of growth rings in some important forest trees.

11. *Varieties of Terminalia tomentosa.*—To study the wood of varieties of *Terminalia tomentosa* in order to find out whether these can be separated microscopically.

12. *Indian Meliaceæ.*—To study woods of the Indian *Meliaceæ* (mahogany family) with a view to finding out some means of separating the species.

13. *Anatomical Structure and Physical Properties.*—To study the relation between anatomical structure and physical properties in common commercial timbers.

Routine Work.

14. *Identification of Woods.*—As and when required.

15. *Identification of charcoals, bamboos, etc.*—As and when required.

TIMBER TESTING SECTION.

Special Inquiries.

16. *Project I.*—To continue work under Project I, namely tests on small clear specimens.

Timbers in stock awaiting tests :—

(1) *Albizzia odoratissima.*
(2) *Alnus nepalensis.*
(3) *Amoora rohituka.*
(4) *Bassia butyracea.*
(5) *Bridelia retusa.*
(6) *Calophyllum* spp.
(7) *Canarium integerrima.*
(8) *Castanopsis hystrix.*
(9) *Chukrasia* spp.
(10) *Cinnamomum iners.*
(11) *Dalbergia latifolia.*
(12) *Engelhardtia spicata.*
(13) *Eugenia* spp.
(14) *Hardwickia pinnata.*
(15) *Heritiera* spp.
(16) *Heterophragma roxburghii.*
(17) *Isonandra* spp.
(18) *Kayea floribunda.*
(19) *Lagerstræmia lanceolata.*
(20) *Mallotus philippinensis.*
(21) *Miliusa velutina.*
(22) *Mimusops littoralis.*
(23) *Pentace griffithii.*
(24) *Podocarpus wallichianus.*
(25) *Pœciloneuron indicum.*
(26) *Pongamia glabra.*
(27) *Pterocarpus santalinus.*
(28) *Saccopetalum tomentosum.*
(29) *Stereospermum chelonoides.*
(30) *Stereospermum xylocarpum.*
(31) *Terminalia myriocarpa.*
(32) *Vitex altissima.*

Timbers on order :—

(1) *Cynometra polyandra.*
(2) *Cedrus deodara.*
(3) *Dipterocarpus macrocarpus.*
(4) *Alæocarpus* spp.
(5) *Eucalyptus eugenoides.*
(6) *Gardenia latifolia.*
(7) *Mimusops hexandra.*

Timbers on order—contd.

(8) *Nephelium longana.*
(9) *Dichopsis polyantha.*

Further timbers for tests :—

(1) *Anthocephalus cadamba.*
(2) *Bombax insigne.*
(3) *Bombax malabaricum.*
(4) *Albizzia procera.*
(5) *Carallia lucida.*
(6) *Dalbergia cultrata.*
(7) *Dalbergia oliveri.*
(8) *Millettia pendula.*
(9) *Terminalia tomentosa.*
(10) *Artocarpus integrifolia.*
(11) *Elecocarpus tuberculatus.*
(12) *Vateria macrocarpa.*
(13) *Eleodendron glaucum.*
(14) *Dipterocarpus indicus.*
(15) *Schleichera trijuga.*
(16) *Acacia lenticularis.*
(17) *Bucklandia populnea.*
(18) *Celtis australis.*
(19) *Callicarpa arborea.*
(20) *Careya arborea.*
(21) *Cassia fistula.*
(22) *Diospyros pyrrhocarpa.*
(23) *Dysoxylum malabaricum.*
(24) *Filicium decipiens.*
(25) *Homalium schlichii.*
(26) *Kayea floribunda.*
(27) *Magnolia pealiana.*
(28) *Melia azedarach.*
(29) *Millingtonia hortensis.*
(30) *Morus indica.*
(31) *Tamarix articulata.*
(32) *Sapium baccatum.*
(33) *Soymida febrifuga.*

17. *Project II.*—To continue work under Project II, namely tests of constructional sizes.

Timbers in stock awaiting tests :—

(1) *Amoora* spp.
(2) *Bassia butyracea.*
(3) *Parishia insignis.*
(4) *Pentace griffithii.*
(5) *Terminalia myriocarpa.*
(6) *Xylia xylocarpa.*

Timbers on order :—

(1) *Dipterocarpus macrocarpus.*
(2) *Gmelina arborea.*
(3) *Mimusops littoralis.*
(4) *Terminalia chebula.*
(5) *Dichopsis polyantha.*

Further timbers for test :—

(1) Species to be chosen by Burma.
(2) *Pæciloneuron indicum.*
(3) *Dalbergia latifolia.*
(4) *Acacia lenticularis.*
(5) *Artocarpus integrifolia.*
(6) *Bischofia javanica.*
(7) *Boswellia serrata.*
(8) *Grewia tiliæfolia.*
(9) *Magnolia pealiana.*
(10) *Morus indica.*
(11) *Planchonia andamanica.*

18. *Project III.*—To continue work under Project III, namely tests on vehicle parts as and when required.

19. *Project IV.*—To continue work under Project IV, namely tests on sleeper woods, and to carry out such special tests as may be required by the Railways on sleeper woods.

Project IV is practically completed, but special tests on sleeper woods are always being required.

20. *Project O.*—To continue work under Project O, under the following sub-heads, as and when required :—

O/C.—Testing of tea-boxes, crates and other containers.
O/K.—Testing of plywoods.
O/B.—Testing of aeroplane parts.
O/H.—Testing of tool handles.
O/E.—Testing of picker arms.
O/General.—Any other special tests required in order to answer enquiries, but of insufficient importance to justify the formation of a special project.

21. *Grading Rules.*—To correlate data from tests under Projects I, II, III, IV and O with the object of compiling grading rules.

22. *Glue Tests.*—To conduct glue tests in collaboration with the Wood-working Section.

The testing of glue joints for the Director of Civil Aviation (from all civil aerodromes in India) is included under this item.

23. *Shearing Tests.*—To make shearing tests comparing results obtained with the standard shearing tool and a special shearing tool equipped with roller bearings.

24. *Shrinkage Test.*—To observe shrinkage in 1″ boards as compared with shrinkage in laboratory shrinkage test specimens.

Routine Work.

25. *Advice to Enquirers.*—To give advice to enquirers on the strength and suitability of timbers for various purposes as and when required. This item takes up quite a considerable amount of time of both the officer in charge and his staff.

SEASONING SECTION.

26. *Demonstration of Correct Methods of Seasoning.*—To demonstrate to the Forest Department and to the public the desirability of, and economy effected by, the use of correct methods of seasoning, by carrying out seasoning experiments at Dehra Dun and elsewhere, and issuing the results from time to time.

27. *Individual Seasoning Problems.*—To co-operate with the Forest Department and timber users, in the solution of individual seasoning problems, and to advise on air-seasoning or the erection of and operation of seasoning kilns whenever required to do so.

28. *Natural Seasoning.*—To continue experiments on natural seasoning, with special reference to the methods of stacking and protecting timber in (i) moist and (ii) dry climatic conditions and to investigate preliminary water soaking prior to seasoning.

29. *Seasoning of Sleepers.*—To continue experiments on the seasoning of sleepers and other forms of sawn timber to prevent splitting, warping and other forms of depreciation.

30. *Project VII.*—To continue experiments under Project VII to determine the maximum temperatures and minimum humidities which will accomplish the seasoning of the more important Indian woods in the shortest time possible without impairing the physical and mechanical properties of the timber.

The following timbers are in stock for this item :—

(1) *Acer campbellii.*
(2) *Amoora wallichii.*
(3) *Eugenia gardneri.*
(4) *Machilus macrantha.*
(5) *Quercus lamellosa.*
(6) *Quercus lineata.*
(7) *Sapium baccatum.*
(8) *Schima wallichii.*
(9) *Terminalia paniculata.*
(10) *Duabanga sonneratioides.*
(11) *Altingia excelsa.*
(12) *Stereospermum chelonoides.*

The following are required for further trial during the triennium :—

Adina cordifolia from the United Provinces or Central Provinces.
Dalbergia sissoo from the United Provinces.
Dipterocarpus turbinatus or *alatus* from Andamans.
Cedrus deodara from Punjab.
Lagerstræmia lanceolata from Bombay.
Tectona grandis from the Central Provinces.
Dichopsis polyantha from Bengal.
Lagerstræmia lanceolata from Madras.
One timber from Assam.

31. *Types of Seasoning Kilns.*—To study the working of different types of seasoning kilns, with special reference to circulation, temperature and humidity control.

Different types of kiln have been and are being installed at Dehra Dun.

32. *Ozone Seasoning.*—To undertake small experiments with ozone for accelerating seasoning of timbers containing oleo-resins.

33. *Vacuum Drying.*—To undertake small experiments on drying timber in a vacuum.

34. *Cost of Kiln Drying.*—To determine the cost of kiln drying from results obtained at Dehra Dun and elsewhere.

35. *Furnace Kiln.*—To carry out experiments on drying timbers in a furnace kiln, in which furnace gases are used directly for evaporating moisture from the wood.

36. *Fundamental Factors of Seasoning.*—To make a special study of the fundamental factors affecting the natural, as well as the artificial drying of wood. This will include investigations on :—

(i) the movement of moisture in wood.
(ii) the stresses in wood during drying.
(iii) the moisture equilibrium of wood at various humidities.

Work has already been started on 36 (iii).

37. *Study of Physical Properties.*—To continue the special study of the various physical properties of wood, *viz.*—

(i) shrinkage.
(ii) density.
(iii) electric resistance.
(iv) heat conductivity.
(v) effect of chemical compounds in wood on moisture content.

Work has already been in progress some time on 37 (i), (ii) and (v).

38. *Steam Bending.*—To study the steam bending of wood in co-operation with the Wood-working Section.

WOOD PRESERVATION SECTION.

Special Inquiries.

39. *Extermination of Termites.*—To investigate the extermination of termites from buildings.

40. *Treatment of Spruce and Fir.*—To continue work on the treatment of spruce and fir sleepers, in order to try and devise a better method of treating these woods.

41. *Investigation on Arsenicals.*—To continue the investigation on the relative value of arsenicals and copper compounds as wood preservatives, with special reference to Falkamesam, zinc-meta-arsenite, arsenic pentoxide, etc.

42. *Falkamesam Process.*—To determine the optimum conditions of treatment of various woods, using the Falkamesam process.

43. *Treatment for Special Properties.*—To investigate the treatment of timber for obtaining special properties.

44. *Viscosity and Penetration.*—To investigate the relation between viscosity and penetration into wood of :—

(*a*) oil preservatives.
(*b*) water soluble preservatives.

45. *Prevention of Splitting.*—To investigate the relative effect and economy of asphaltic, bituminous, or similar compounds in wood preservation, to protect the wood from splitting.

Routine Work.

46. *Durability Trials.*—To continue keeping under observation the experimentally treated sleepers laid in the various lines throughout India and Burma for durability trials.

47. "*Grave-yard*" *Tests.*—To continue the "grave-yard" tests on treated and untreated woods in order to ascertain their relative liability to fungus and insect attack.

48. *Advice to Inquirers.*—To give advice as and when required on all questions connected with wood preservation, including the selection and erection of plant for the treatment of wood in India.

PAPER PULP SECTION.

Special Inquiries.

49. *Utilisation of Bamboos for Pulp and Paper*—

(1) Chemical analyses of the following :—

(*a*) *Bambusa arundinacea.*
(*b*) *Dendrocalamus strictus.*
(*c*) *Oxytenanthera nigrociliata.*

(2) Application of different chemical processes to find out which gives the best results with various species for the production of different classes of paper.

(3) Application of soda and sulphate processes for pulp and paper to :—

(*a*) *Dendrocalamus hamiltonii* (*kokwa*).
(*b*) *Bambusa tulda* (*mitenga*).
(*c*) *Teinostachyum dullooa* (*dolu*).
(*d*) *Dendrocalamus longispathus* (*orah*).
(*e*) *Oxytenanthera auriculata* (*kaliserri*).

(4) Preparation of a pulp suitable for artificial silk.

50. *Utilisation of Grasses for Pulp and Paper*—

(1) Chemical analyses of the following :—

(*a*) *sabai* (*Ischœmum angustifolium*).
(*b*) *bhulwa* (*Eragrostis elegantula*).
(*c*) *kans* (*Saccharum spontaneum*).
(*d*) *dab* (*Desmostachya cynosurcides*).
(*e*) *ulla* (*Anthistiria gigantea*).

(2) Application of different chemical processes to *sabai*, *kans*, *ulla*, and *dab* grasses for the production of badami, bleached and half-bleached papers.

(3) Examination of savannah grasses other than those mentioned above, for the manufacture of pulp and paper, as and when required.

51. *Utilisation of Woods for Pulp and Paper*—

(1) Chemical analyses of the following :—

(*a*) spruce (*Picea morinda*).
(*b*) fir (*Abies pindrow*).
(*c*) *chir* pine (*Pinus longifolia*).
(*d*) *Pinus insignis.*

(2) Application of chemical processes to (*a*), (*b*), (*c*) and (*d*) above for the production of kraft, bleached and unbleached papers.

(3) Preliminary experiments on the manufacture of mechanical pulp from Indian woods.

(4) Preliminary study of the applicability of commercial pulping processes to one or two broad-leaved woods.

52. *Variables in Alkaline Processes.*—Study of the variables of digestion in order to establish scientific methods for the control of digestion by the alkaline processes.

Routine Work.

53. *Advice to Inquirers.*—Giving technical advice, as and when required, to Forest Officers, other Government Departments and prospective pulp and paper manufacturers on matters relative to the exploration of forest areas, the examination of manufacturing and transport facilities, supplies, chemical processes, costs of production, plant and machinery etcetera.

WOOD WORKING SECTION.

54. *Veneers, Plywood and Glues.*—To continue work under *Project VIII* as follows :—

(*a*) Tests on Indian woods for veneers and plywood.

Timbers in stock awaiting tests :—

(1) *Tectona grandis.*
(2) *Grevillea robusta.*
(3) *Swintonia floribunda.*
(4) *Parashorea stellata.*
(5) *Anisoptera glabra.*

Timbers on order :—

(1) *Machilus macrantha.*
(2) *Palaquium ellipticum.*
(3) *Aglaia odoratissima.*
(4) *Lagerstræmia flos-reginæ.*
(5) *Lagerstræmia tomentosa.*
(6) *Pterocarpus macrocarpus.*
(7) *Alœocarpus tuberculatus.*
(8) *Litsæa wightiana.*
(9) *Amoora canarana.*
(10) *Terminalia tomentosa.*
(11) *Pentace burmanica.*

Further timbers for tests :—

(1) *Artocarpus chaplasha.*
(2) *Dalbergia oliveri.*
(3) *Eugenia jambolana.*
(4) *Gmelina arborea.*
(5) *Hopea odorata.*
(6) *Ougeinia dalbergioides.*
(7) *Pterocarpus marsupium.*
(8) *Terminalia bialata* (silver grey).
(9) *Terminalia manii.*
(10) *Abies pindrow.*
(11) *Bombax insigne.*
(12) *Anisoptera* spp.
(13) *Anogeissus latifolia.*
(14) *Canarium euphyllum.*
(15) *Carapa moluccensis.*
(16) *Lophopetalum wightianum.*
(17) *Castanopsis hystrix.*
(18) *Dillenia pentagyna.*
(19) *Lophopetalum fimbriatum.*
(20) *Lophopetalum tomentosum.*
(21) *Michelia champaca.*
(22) *Morus? œvigata.*

(23) *Nyssa* spp.
(24) *Parishia insignis.*
(25) *Saccopetalum tomentosum.*
(26) *Sideroxylon longepetiolatum.*
(27) *Swintonia* spp.
(28) *Talauma phellocarpa.*
(29) *Terminalia arjuna.*
(30) *Terminalia procera.*
(31) *Tetrameles nudiflora.*
(32) *Boswellia serrata.*
(33) *Cedrela* spp.
(34) *Cedrus deodara.*
(35) *Cupressus* spp.
(36) *Gmelina arborea.*
(37) *Mangifera* spp.
(38) *Pinus longifolia.*
(39) *Shorea assamica.*
(40) *Sterculia campanulata.*

(*b*) Tests on glues—as and when required.

55. *Gum of Duabanga.*—To investigate the black gum which exudes from the wood of *Duabanga sonneratioides* making the use of the wood for tea boxes impossible.

56. *Working Qualities of Indian Woods.*—To investigate and observe the working qualities of Indian woods with a view to finding out the uses for which they are suitable.

This item is partly routine work and partly special research. All timbers passing through the workshops are observed and notes kept thereon, whereas very often specimens are sent in from Forest Officers and timber users for special reports as to working qualities or fitness for some special use.

CHEMICAL BRANCH.

1. *Fats and Oils.*—General study of the chemistry and commercial uses of fats and oils :—

(i) *Celastrus paniculata.*—The seeds are useful in gout, paralysis, leprosy, beri-beri, etc. The oil from the seeds is known as " black oil " and appears to have the same properties as that from *Psoralia corilifolia* which is used in cases of leucoderma. Found in the Punjab and Burma, also in Dehra Dun.

(ii) *Melia azedarach.*—The oil has never been studied, though many medicinal virtues are attributed to it. It is usually confused with the oil from *Azederachta indica* which contains an important acid, margosic acid.

(iii) *Rhus cotinus.*—The fat from the seeds may be similar to the Japan wax, which is obtained from *Rhus succedanea*, found in Indo-China. This and the following fats (iv, v, and vi) are proposed for investigation in the hope of discovering other sources of vegetable tallow. A preliminary account on this subject has already appeared in the *Indian Forester*, Feb. 1932 (' The seeds of *Vateria indica* as a source of vegetable tallow ').

(iv) *Bassia butyracea.*—Known as the ' butter tree ' indigenous to the Himalayas, and an important food stuff locally. Found in Kumaon to Bhotan, and Sub-tropical Himalaya.

(v) *Ximenia americana, Linn.*—The fat is used as a substitute for *ghee*. Found in Coastal tracts of Tennasserim, Mysore and Madras Presidency.

(vi) *Dipterocarpus indicus.*—Expected to yield a wax-like fat. Found in Western Ghats.

2. *Medicinal Herbs.*—General study of the active chemical principles of the following medicinal herbs :—

(i) *Indian Artemisias.*—It has, hitherto, been the belief that *Artemisias* of high santonine content are found only at high altitudes and dry localities, but experiments with its cultivation at the Forest Research Institute show that this is not strictly true. It is now proposed to examine this drug from other parts of India.

(ii) *Actinodaphne hookeri.*—This drug is reputed in Ayurvedic medicine to be efficacious in diabetic diseases. An alkaloid actinodaphnine has been isolated from the drug and it is proposed to study its chemistry and pharmacology. Found in Western Ghats.

(iii) *Putranjiva roxburghii.*—The seeds are believed to be efficacious for certain skin diseases. Oil from them has already been investigated but the cause of its therapeutic value has not been found. The pulp outside the seeds contains

a glycoside and this appears to be the physiologically active principle.

(iv) *Derris.*—Some species are used as a fish poison and insecticide. The active principle is rotenone which is usually extracted from *D. elliptica.* The Agricultural Expert with the Imperial Council of Agricultural Research has desired a re-examination of *D. uliginosa.* Found in Sunderbans, Chittagong and Central Bengal.

(v) *Vitex negundo and V. peduncularis.*—These have a great reputation in certain parts of India, as febrifuge, but very little is known about their active principles. Found throughout India, chiefly Behar and Bengal.

(vi) *Curcuma augustifolia.*—The arrowroot from this plant is used medicinally in some parts of the country. A fairly large trade exists in this all over India. Found in Assam.

(vii) *Andrographis paniculata.*—Has a bitter active principle, the preliminary nature of which is already known. Found in the Central Provinces.

3. *Soil Problems*—

(i) Study of the seasonal variation in soil moisture proposed by the Silviculturist, Forest Research Institute. It is intended to carry out the investigations in the Demonstration Area and to study the effect of soil composition and condition on a variety of trees.

(ii) Study of the effects of cover crop on soil moisture. Suggested by the Silviculturist.

4. *Miscellaneous Work.*—Such enquiries as may be received.

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ROYAL ASIATIC

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THE FOREST RESEARCH INSTITUTE, DEHRA DUN,

FOR

1936-39.

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With compliments
from
the President,
Forest Research Institute & College,
Dehra Dun, U.P.

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SILVICULTURAL BRANCH.

Serial No.	Proposals.	Explanatory remarks.
	I.—ROUTINE WORK.	
1	(a) *Ledger Files.*—Maintenance of specific and general ledger files collecting all information available from publications, tour notes, etc. The photographic collections are included in this work. (b) *Provincial Experimental Plot Files.*—Scrutiny and record of all provincial Experimental Plot files. (c) *Provincial Sample Plot Files.*—Scrutiny, computation and record of all provincial Sample Plot Files. (d) *Touring.*—Inspection of representative Experimental and Statistical plots and silvicultural problems in the provinces as occasion demands and circumstances allow. (e) *Improvements of Research Technique.*—Investigations of promising suggestions for improvements of research technique under Indian conditions, wherever opportunities exist.	
	II. COMPILATION OF PUBLICATIONS.	
2	*Publication* on— (a) *Selected General Subjects*— (1) Statistical problems in irregular crops. (2) Revision of Experimental Manual. (3) Revision of Statistical Code. (4) Manual of forest photography. (5) Regeneration of evergreen forests. (6) Mixtures in plantations. (7) Root competition. (8) Phenological data for locally grown species. (9) Cover crops in Forestry. (10) Thinnings. (b) *Selected Species*— 1. Revision of Forest Bulletin No. 78 (Problem of the Pure Teak Plantation).	

Serial No.	Proposals.	Explanatory remarks.
	2. Yield tables for teak. 3. Revised yield tables for sal. 4. Teak plantation technique. 5. Regeneration, natural and artificial, of the more important Dipterocarps	
	III.—EXPERIMENTAL SILVICULTURE.	
	(i) Seed Investigations.	
3	Determination of seed weights, germination and plant percents for all species of importance.	
4	*Seed Storage.*—For important species.	
5	*Aids to Germination.*—For species with which difficulty is experienced in the provinces.	
	(ii) Seedling Investigations.	
6	*Artificial Regeneration methods.*—For important species not yet dealt with fully (as far as local conditions permit).	
	(iii) Tree and Crop Investigations.	
7	*Seed Origin Problems.*—Investigations to be continued for the chief species used in plantations and for the special problems of— (1) Spiral grain in *chir* pine, etc. (2) Figured wood in *Terminalia tomentosa*, *Chickrassia*, etc. (3) Heartwood and oil in sandalwood. (4) Solid culms in bamboo. (5) Resin production in *chir* pine.	A most important matter, but not much new work is called for in the next triennium.
8	*Phenological data.*—Records to date will be summarised and published (Provinces have been asked to co-operate with sal and teak). Additional species will be taken up.	Provinces are collaborating.
	(iv) Management Problems.	
9	*Rotation, etc., of Bamboo.*—Routine continuation of the investigations started in co-operation with the provinces. Effect of different methods of cutting on rhizome production to be included.	An All-India investigation has been initiated, sets of plots having been laid out in different provinces by the Forest Research Institute for *Dendrocalamus strictus*. Extension of the investigation to other species of bamboos, *e.g.*, *Melocanna* will be done as required.

Serial No.	Proposals.	Explanatory remarks.
	(*iv*) *Management Problems*—contd.	
10	*Grazing combined with forestry.*—Co-operative investigation in interested provinces, inspection of experiments and some assistance in laying them out would be required, (*vide* Silvicultural Conference, 1934, Item No. 20).	
	(*v*) *Protection Problems.*	
11	*Erosion.*—Co-operation with provinces if they undertake investigations (Silvicultural Conference, 1934, Item 21).	The field work must be done by provinces, the F. R. I. will advise in experimental methods and analysis of the data collected. A start has been made in the Central Provinces.
12	*Forest Grazing.*—Co-operation with provinces if they undertake investigations (Silvicultural Conference, 1929, Item 20).	
13	*Congestion in bamboo.*—Investigations into the causes to be continued. Practica remedy for congested clumps.	
14	*Spiral grain.*—Continuation and analysis of investigation in the case of *chir* pine only.	
	(*vi*) *Physiological Problem.*	
15	*Root Competition.*—Experiments into the effect of undergrowth on the rate of growth of sal and *chir* pine will be continued and other species added. [Silvicultural Conference. 1934, Item 6(*c*). Other investigations to be taken up as opportunity offers.	Specially asked for by seven provinces in 1929.
	(*vii*) *Soil Problems.*	
16	*Effect of Forest Cover on the Soil* and recognition of soil conditions.	This item is stressed by several provinces mainly in connection with natural regeneration problems. Methods of study and interpretation of data are asked for.
17	*Effect of Afforestation on Soil.*—Existing investigation to be concluded and analysed in 1937. New work to be taken up in *khair* areas in 1937.	

Serial No.	Proposals.	Explanatory remarks.
18	*Cover Crops.*—Investigations with likely species to continue, and results to be published when sufficient data have accumulated.	*Cf.* head II (*a*) 9. Routine work in the Experimental Garden capable of expansion or reduction according to staff and funds. The importance of the work done depends on that of the problems arising in provincial practice, but I attach value to it as keeping me and my staff in touch with practical work and providing the opportunities required for testing experimental methods.
19	*Effect of burning on soil* conditions and cover.	
	IV. STATISTICAL.	
20	*Yield Tables.*—Yield table and stand table for plantation teak for all India and Burma to be completed. Revision of 1923 sal yield table with addition of assortment tables and form quotient data.	There is a demand for teak and revised sal yield tables. The teak table compilation has been started and the sal table will be taken up when it is finished.
21	*Sample Plot Work.*—Further investigations into the use of standing sample trees including photogrammetric methods. Continental sample plot methods to be studied and tested for their applicability to Indian conditions.	The measurement of standing sample trees has been introduced but further researches with improved methods are required.
22	*Volume Tables.*—Co-operation with the provinces in preparing tables as required by them. *Dalbergia sissoo* and *Terminalia tomentosa* to be taken up. Also silver fir.	Volume tables are primarily a matter for the provinces, but in view of the interest of most species to more than one province, our co-operation is advisable, furthering uniformity of methods, etc.
23	*Sapwood studies.*—Preliminary data for deodar to be analysed and further data to be collected if required. Sal to be investigated next, followed by teak and sandalwood.	Specially urgently required in the Punjab and United Provinces for deodar and sal. Preliminary data for deodar collected and are being used to determine the best methods of tackling the subject. Sal will be more difficult. The assistance of the provinces concerned will probably be necessary.

Serial No.	Proposals.	Explanatory remarks.
24	*Statistics for irregular crops.*—Working up of data collected by the provinces and investigation of best methods of analysis. Co-operative investigations with provinces (Silvicultural Conference, 1934, Item 11c). Value and application of stump analysis data.	
25	*Thinnings, etc.*—	
	(*a*) Investigation of Heck's and Gerhardt's methods of thinning in addition to usual grades and cycles in comparative thinning sets in co-operation with the provinces.	Sample plots are slow to yield results and almost all old thinning plots have failed in their purpose. Provisional data are required to cover the next decade or two.
	(*b*) Testing out Hart's, Geerling's, Craib's and Grockowski's suggestions in Forest Research Institute plantations and elsewhere.	Bihar and Orissa requires information as to Heck's and Gerhardt's methods.
	(*c*) Field studies to give provisional data for use pending results from comparative plots.	
	(*d*) Drawing up and testing a standard classification of thinnings for young crops.	
	(*e*) Effect of incomplete stocking on increment.	
26	*Loss of Increment from Defoliation.*—In collaboration with Forest Entomologist and provinces.	No data are known to exist on this point and are essential for consideration of proposed control measures. Some work has been done in Dehra, but a field party should go to Nilambur or similarly affected locality. The Entomologist has some plots under observation.

BOTANICAL BRANCH.

Serial No.	Proposals.	Explanatory remarks.
	FOREST BOTANY.	
1	*Plants of Forest Importance.*—Illustrations and descriptions of Indian plants of forest importance imperfectly known or hitherto confused or overlooked.	
2	*Dipterocarpaceæ.*—A systematic study of the Indian species of *Shorea*, *Hopea* and *Anisoptera*.	
3	*Terminalias.*—A systematic study of the Indian and Burmese species of *Terminalia*.	
4	*Bambusaceæ.*—Systematic studies relating to the Indian and Burmese species of *Bambusaceæ*.	
5	*Arboretum and Botanical Garden.*—The establishment of an Arboretum and Botanical Garden at the Forest Research Institute at Dehra Dun. Further planting will be done in the Arboretum and a Botanical Garden established in which plants of educational and economic importance and æsthetic interest will be grown.	
6	*Summarising of recent advances in botanical science.*—An annual summary of the most important developments of botanical science in India, especially relating to Forestry, will be made.	
7	*Nomenclature of Plants of forest importance.*—The preparation of a list of Indian plants the names of which should be conserved and a list showing the names that should be used by Forest Officers for the more important Indian plants.	
8	*Routine work.*—Identification of herbarium specimens sent in by Forest Officers; the collection, naming and exchange of herbarium material for the Dehra Dun herbarium; supplying information and answering enquiries on botanical subjects; seed supply.	
9	Study of Indian forest grasses.	
10	Preparation of a monograph of Indian species of *Eugenia*.	
	MYCOLOGY.	
11	*Sal root disease including Polyporus shoreæ.*—To be taken up with the investigation of other sal diseases in the United Provinces, Bihar and Orissa and Assam. A study of the fungus flora of sal forest soil will be undertaken.	

Serial No.	Proposals.	Explanatory remarks.
12	*Mycorrhizal fungi.*—A study of the mycorrhiza of coniferous trees will be taken up including blue pine and silver fir (Punjab).	
13	*Die-back disease of Gmelina arborea.*—Cultural and inoculation studies will be continued.	
14	*Damping off of the forest tree seedlings.*—Studies on the effects of soil media and control measures will be continued.	
15	*Cultural studies of wood-rotting fungi.*—Observations will be continued and work with associated fungi will be taken up.	
16	*Pathogenic studies of some coniferous fungi.*—Studies on the parasitism of *Fomes annosus, Armillaria* sp. and *Trametes pini* on *Cedrus deodara* and *Pinus excelsa* will be continued.	

ENTOMOLOGICAL BRANCH.

A.—BIOLOGY AND CONTROL.

I. Insect pests of living trees.

1. *Acacia catechu.*—Defoliation in United Provinces.
2. *Acrocarpus fraxinifolius*—
   (*a*) Defoliation by *Terias silhetana*, etc., in North Bengal and Madras.
   (*b*) Shoot-borers and connexion of borers with dying-back.
3. *Alnus nepalensis.*—Survey of pests in North Bengal.
4. *Amoora wallichii.*—Bark and shoot-borers in Assam and North Bengal.

*5. *Bamboos.*—
   (*a*) Weevil and chrysomelid borers of living bamboos in Central Provinces, Madras, Punjab and United Provinces.
   (*b*) Caterpillar and grasshopper defoliators in Punjab and United Provinces.

6. *Bombax malabaricum.*—Shoot-borer in Central Provinces.
7. *Cassia siamea*—
   (*a*) Defoliators in Madras.
   (*b*) Borers and connexion of the same with dying-back of seedlings in Madras.
8. *Casuarina equisetifolia.*—Survey of pests of casuarina plantations in Bihar and Orissa and Bombay.
9. *Cedrus deodara*—
   (*a*) Defoliation by *Ectropis deodarae* in Punjab.
   *(*b*) Cockchafer and cutworm damage in nurseries and regeneration areas in the North-West Frontier Province, Punjab and United Provinces.
10. *Cryptomeria japonica.*—Survey of pests in Bengal.
11. *Dalbergia sissoo*—
   *(*a*) Defoliation. Publication of biology of defoliators and the factors of biological, direct and silvicultural control in irrigated plantations.
   (*b*) Borers of fuel-stacks in Punjab.
12. *Duabanga sonneratioides.*—Survey of pests in Bengal
12-a. *Elettaria cardamom.*—Fruit borers in Coorg.

13. *Gmelina arborea.*—Defoliation by *Calopepla leayana* in plantations and possibilities of biological control in Assam, Bengal and Burma.

14. *Lantana*—

(*a*) the possibilities of local control of lantana by artificial multiplication of indigenous insect pests.

(*b*) the possibilities of introducing to India other species of lantana insects.

*15. *Michelia champaca.*—Dying-back due to *Urostylis punctigera* in Bengal. Possibilities of biological control.

*16. *Morus indica.*—Defoliation by various species in Punjab and United Provinces and possibilities of biological control.

17. *Quercus dilatata and Q. incana.*—Defoliation by *Lasiocampids* in United Provinces.

18. *Santalum album*—

*(*a*) Entomological investigation of the spike disease of sandal in collaboration with the Provincial Silviculturist, Madras.

(*b*) Biological research for the control of a proved vector or vectors in Coorg and Madras.

(*c*) Completion of publication of the series of *Records* on the insect fauna of sandal.

19. *Shorea robusta*—

*(*a*) Defoliation in Assam and North Bengal.

(*b*) Preparation of a guide to the borers of *Shorea robusta*, their biology, means of recognising the insects and damage, the preventive and remedial measures in theory and practice (for Assam, Bihar, Orissa, Bengal, Central Provinces and United Provinces).

(*c*) Insect pests of sal taungyas in Assam, Bengal and United Provinces.

20. *Swietenia microphylla and S. mahagoni*—

(*a*) Shoot-borer in Bengal and Madras.

(*b*) Stem-borer and root-collar borers in Bengal and Madras.

21. *Tamarix articulata and other species.*—Survey of soil insect including termites in Punjab.

22. *Tectona grandis*—

*(*a*) *Defoliation.*—Field-investigation of the factors of biological control with the object of introducing natural enemies and discovering deficiencies in silvicultural control in plantations in Bengal, Burma and Madras.

(*b*) Record of the results of control, *i.e.*, intensity and frequency of defoliation over a period of years in collaboration with Forest departments.

(*c*) Preparation of a guide to the defoliators of *Tectona grandis*, their biology, means of recognising the insects and damage, the preventive and remedial measures in theory and practice (for Bengal, Burma and Madras).

(*d*) *Borers.*—Biology of *Phassus malabaricus* in Bombay.

(*e*) Collaboration with the Forest Entomologist, Burma, in research on the beehole borer of teak.

II.—INSECT PESTS OF FELLED TREES AND TIMBER.

23. *Borers of newly felled trees—*

(*a*) Continuation of survey of borers of newly felled trees, their life-histories, distribution and food-plants.

(*b*) Experiments to determine protection by methods of felling, extraction, seasoning, conversion, etc.

24. *Borers of converted or manufactured timber—*

(*a*) Investigation of measures for the protection of converted timber from damage by *Bostrychids*, *Lyctus* beetles, dry wood borers, etc., especially in box, plywood and furniture factories.

(*b*) Control of borers of bamboos in storage depots in Assam, Bihar, Orissa, Bengal, Burma, United Provinces, and in arsenals and factories, etc.

25. *Termites.*—Investigation of the biology and control of termites damaging timber.

B.—GENERAL ECONOMIC ENTOMOLOGY.

26. *Parasites and predators.*—Life histories and distribution and alternate hosts of parasites and predators of all pests of trees and timber under study with particular reference to their value in biological control.

*27. *Biologies.*—Publication of notes on the biology of forest insects by families in the Biology series of *Records* (Bostrychidae, Cerambycidae, Curculionidae, Platypodidae and lepidopterous families will be dealt with first).

28. *Text-books and guides—*

(*a*) Preparation of a text-book on the principles and practice of protection against forest insect pests in India (Required by all provinces).

(*b*) Preparation of a reference work to the biology of Indian forest insects as a companion volume to No. 27 (*a*),

* (c) Preparation of a series of " popular " guides each limited to the insect pests of one species of tree :—

Species of tree.	Provinces interested.
Abies pindrow	Punjab.
Acacia arabica	Central Provinces.
Acacia catechu	United Provinces.
Adina cordifolia	Bihar and Orissa.
Alnus nepalensis	Bengal.
Artocarpus chaplasha	Bengal.
Bombax malabaricum	Bihar, Orissa and Central Provinces.
Cassia siamea	Madras.
Cedrela toona	Bengal.
Cedrus deodara	Punjab, United Provinces.
Cryptomeria japonica	Bengal.
Dalbergia latifolia	Bihar and Orissa.
Dalbergia sissoo	Bihar, Orissa, Punjab and United Provinces.
Dendrocalamus strictus	Punjab.
Eugenia jambolana	United Provinces.
Gmelina arborea	Bengal.
Hymenodictyon excelsum	Bihar and Orissa.
Juglans regia	Bengal.
Michelia champaca	Bengal.
Ougeinia dalbergioides	Bihar and Orissa.
Picea morinda	Punjab.
Pinus excelsa	Punjab.
Pinus longifolia	Punjab, United Provinces.
Pterocarpus marsupium	Bihar and Orissa.
Saccopetalum tomentosum	Bihar and Orissa.
Santalum album	Bombay.
Shorea robusta	Bihar, Orissa, Bengal and Central Provinces.
Tamarix articulata	United Provinces, Punjab.
Tectona grandis	Bengal, Bombay, Central Provinces, Madras, United Provinces.
Terminalia tomentosa	Bihar and Orissa.

C.—SYSTEMATIC ENTOMOLOGY.

Identification.

29. Identification at Dehra Dun of insects sent in by forest departments, or collected by touring parties, or bred in the insectary.

30. Distribution of material to collaborating specialists throughout the world.

Taxonomy.

31. Description of early stages of pest species and their allies and associates with particular reference to wood boring larvæ and soil insects (nursery pests).

32. Publication of further contributions to the series "Immature Stages of Indian Coleoptera".

33. Revision of the Indian Cerambycidae.

34. Revision of the oriental Scolytidae and Platypodidae.

35. Publication of the data of the sandal insect survey in the series "Entomological Investigations on the Spike Disease of Sandal."

36. Publication of systematic papers by specialists in *Indian Forest Records* and in foreign periodicals.

37. Maintenance of a card-index of newly described Indian species and keeping up to date of published catalogues.

ECONOMIC BRANCH.

Serial No.	Proposals.	Explanatory remarks.
	MINOR FOREST PRODUCTION SECTION.	
1	*Match splints and box veneers.*—To continue to test such species as came to hand for suitability for the manufacture of match splints and box veneers, in co-operation with the Western India Match Co., and to collect and record all information received from match manufacturers as regards the suitability of the species used by them.	
2	*Portable charcoal kiln.*—To continue the investigation on the "life" of the "F.R.I. Portable Charcoal Kiln", by doing as many burnings as possible as and when opportunities occur.	This investigation will be continued when material to burn is available.
3	*Briquetting.*—To continue experiments on charcoal briquetting with the Ovoid briquetting press, using *Bauhinia retusa* gum, powdered rice, maize, *jao*, *jowar*, and *ragi* as binders.	Charcoal briquetting will not be a commercial success unless the cost of briquetting can be reduced. The future line of work will be to find a suitable binder from waste products of little or no value at present.
4	*Cultivation of medicinal plants.*—As many species as possible will be tried from the list prepared by us and approved by Lt.-Col. R. N. Chopra, I.M.S., Professor of Pharmacology, School of Tropical Medicine, Calcutta.	
5	*Substitute for cork.*—Finding out Indian substitutes for cork for use as insulators in refrigerators.	
6	*Producer gas.*—Testing of a portable producer gas plant for use with a petrol driven lorry under Indian conditions.	
7	*Match wood plantations.*—To make out a list of species suitable for starting plantations for supplying match woods to Indian Match Factories.	Imports of finished matches, splints and veneers into India have become negligible and the Match Factories in India are using Indian woods both for splints and boxes. Unless the question of starting plantations in suitable localities is taken up now, all forests from which it is economically possible to get suitable species will be exhausted and it may be necessary to import wood from foreign countries.

Serial No.	Proposals.	Explanatory remarks.
8	*Improving indigenous methods of charcoal making.*—To investigate the possibility of improving the indigenous methods of charcoal making, to make it more automatic so that ordinary forest labour can manage the kiln with very little training.	As it has not been possible to reduce the cost of the 'F. R. I. Portable Charcoal Kiln' attention will be paid towards improving indigenous methods. Unless this is done, the market for charcoal will be captured by soft coke from Indian collieries.
9	*Bleaching of bamboos and canes.*—Bleaching bamboos and canes for use in high class furniture work.	Bamboo is not used at present for high class furniture work on account of its appearance, and its inability to take a coating of paint or varnish readily. Bleaching, which produces a pretty cream colour, would solve this problem.
10	Suitability of *Pinus longifolia* and *Alnus nepalensis* for packing cases for fruits.	
	WOOD TECHNOLOGY SECTION.	
11	*Keys for the identification of commercial woods.*—The preparation of keys supplemented with X 10 photo-micrographs for the identification of important commercial woods for each province: *i.* Assam commercial timbers to be continued. *ii.* Bengal commercial timbers to be continued. *iii.* United Provinces and Madras commercial timbers will be taken up.	
12	*Woods of the Dipterocarpaceæ.*—To study the woods of the *Dipterocarpaceæ* with a view to finding a means of separating the species.	
13	*Shrinkage of wood.*—To investigate the causes of difference in shrinkage of wood from different parts of a tree. Work has already been started with *Cedrela toona*, (to be continued).	
*14	*Growth rings*— To continue the study of growth rings in some important forest trees: (*a*) *Acacia catechu.* (*b*) *Bombax malabaricum.* (*c*) *Eugenia jambolana.*	

Serial No.	Proposals.	Explanatory remarks.
	(*d*) *Pinus longifolia.* (*e*) *Shorea robusta.* (*f*) *Tectona grandis.* (*g*) *Terminalia tomentosa.* (*h*) *Santalum album.* Publication on the evolution of some diffuse porous woods in tropics.	
15	TIMBER TESTING SECTION. *Project I.*—To continue work under Project I, namely, tests on small clear specimens.	

TIMBER IN STOCK AWAITING TESTS.

Species.	Locality.
(1) *Ailanthus grandis.*	Buxa, Bengal.
(2) *Albizzia odoratissima.*	South Coimbatore, Madras.
(3) *Amoora rohituka.*	Nowgong, Assam.
(4) *Amoora* spp.	Rangoon, Burma.
(5) *Artocarpus integrifolia,* (hill grown).	Chepauk, Madras.
(6) *Artocarpus integrifolia,* (plain grown).	Do.
(7) *Balanocarpus utilis*	Tinnevelly, Madras.
(8) *Bassia butyracea*	South Andaman.
(9) *Carallia integerrima*	Nowgong, Assam.
(10) *Chukrasia* spp.	Rangoon, Burma.
(11) *Cinnamomum iners*	Do.
(12) *Dalbergia cultrata*	Do.
(13) *Elæocarpus tuberculatus*	North Mangalore, Madras.
(14) *Engelhardtia spicata*	Cachar, Assam.
(15) *Eugenia* spp.	Do.
(16) *Grewia elastica*	Kurseong, Bengal.
(17) *Hardwickia pinnata*	South Mangalore, Madras.
(18) *Heterophragma roxburghii.*	Chanda, C. P.
(19) *Mesua ferrea*	Tinnevelly, Madras.
(20) *Millettia pendula*	Rangoon, Burma.
(21) *Mimusops littoralis*	South Andaman.
(22) *Pentace griffithii.*	Rangoon, Burma
(23) *Pœciloneuron indicum*	Mangalore, Madras.
(24) *Pongamia glabra*	Kanara, Bombay.
(25) *Pterocarpus santalinus*	South Cuddapah, Madras.
(26) *Saccopetalum tomentosum.*	Kanara, Bombay.
(27) *Stereospermum chelonoides.*	South Mangalore, Madras.
(28) *Terminalia myriocarpa*	Lakhimpur, Assam.
(29) „ *tomentosa*	Rangoon, Burma.
(30) *Lophopetalum fimbriatum.*	Bengal.
(31) *Aesculus indica*	North West Frontier Province.
(32) *Boswellia serrata*	Central Provinces.

Serial No.	Proposals.	Explanatory remarks.
	TIMBERS ON ORDER.	
	(1) *Artocarpus integrifolia* . Colombo, Ceylon. (2) *Carallia lucida* . . Rangoon, Burma. (3) *Cedrus deodara* . . Udhampur, Kashmir. (4) *Cynometra polyandra* . Cachar, Assam. (5) *Dalbergia oliveri* . . Rangoon, Burma. (6) *Dipterocarpus macrocarpus.* Do. (7) „ *pilosus* . Do. (8) *Gardenia latifolia* . Bihar and Orissa. (9) *Heritiera* spp. . . Cachar, Assam. (10) *Mimusops hexandra* . Ranchi, Bihar and Orissa. (11) *Nephelium longana* . Cachar, Assam.	
	NOTE.—We have in stock already enough timber for more than two years ordinary work.	
	FURTHER TIMBERS FOR TEST.	
	(1) *Acacia lenticularis* . Tanakpur, United Provinces. (2) *Bucklandia populnea*. Assam or Bengal. (3) *Callicarpa arborea* . Burma. (4) *Cassia fistula* . . United Provinces. (5) *Diospyros pyrrhocarpa*. (6) *Dipterocarpus indicus* Bombay. (7) *Dysoxylum malabaricum* Do. (8) *Eleodendron glaucum*. (9) *Filicium decipiens* . Madras and Bombay. (10) *Homalium schlichii* . Assam. (11) *Magnolia pealiana* . Do. (12) *Melia azedarach*. (13) *Millingtonia hortensis*. Bihar and Orissa. (14) *Morus indica* . . Punjab. (15) *Sapium baccatum*. (16) *Schleichera trijuga*. (17) *Soymida febrifuga* . Chepauk, Madras. (18) *Tamarix articulata* . Punjab. (19) *Vateria macrocarpa*. and any other species that may be specially suggested by provinces.	
16	*Project II.*—To continue work under Project II, namely tests of constructional sizes.	
	TIMBERS IN STOCK AWAITING TESTS.	
	Species. Locality. (1) *Dalbergia latifolia* . Chepauk, Madras. (2) *Pentace griffithii* . . Rangoon, Burma. (3) *Pæciloneuron indicum*. Mangalore, Madras. (4) *Terminalia myriocarpa* Lakhimpur, Assam. (5) „ *tomentosa* . Rangoon, Burma. Also 22 consignments that are being air-seasoned.	

Serial No.	Proposals.	Explanatory remarks.
	TIMBERS ON ORDER.	
	(1) *Dipterocarpus macrocarpus.* — Rangoon, Burma. (2) *Gmelina arborea* . — Do. (3) *Mimusops littoralis* . — South Andaman. (4) *Terminalia chebula* . — Rangoon, Burma.	
	FURTHER TIMBERS FOR TEST.	
	(1) *Acacia lenticularis* . — Tanakpur, United Provinces. (2) *Bischofiajavanica.* . — Madras. (3) *Boswellia serrata* . — Bihar and Orissa. (4) *Grewia tiliaefolia* . — Madras. (5) *Magnolia pealiana* . — Assam. (6) *Morus indica.* . — Punjab. (7) *Planchonia andamanica* — Andamans. Any other species that may be specially suggested by provinces.	
17	*Project III.*—To continue work under Project III, namely tests on sleeper woods, and to carry out such special tests as may be required by the Railways on sleeper woods.	Project III is practically completed but special tests on sleeper woods are often required. No material was received for test during the last triennium.
18	*Project O.*—To continue work under Project O, under the following sub-heads, as and when required— O/C Testing of tea-boxes, crates and other containers. O/K Testing of plywood. O/B „ aeroplane parts. O/H „ tool handles. O/E „ picker arms.	
19	*Grading Rules*— To correlate data from tests under Projects I, II, III and O with the object of compiling grading rules. To take in hand the preparation of grading rules for Andaman padauk only.	
20	*Glue tests*— To conduct glue tests in collaboration with the Wood-Working Section. The testing of glue joints for the Director of Civil Aviation (from all Civil Aerodromes in India) is included under this item.	

Serial No.	Proposals.	Explanatory remarks.
21	*Shearing tests.*—To make shearing tests comparing results obtained with the standard shearing tool and a special shearing tool equipped with roller bearings.	
22	*Reduction of all air dry strength values to uniform moisture content*— Strength values in air dry condition are at present given at the moisture content at the time of test which generally varies by a small amount. In order to have a fair comparison among the species it is essential to reduce the values to a uniform moisture content, 12 per cent. is taken as a standard in all laboratories including Dehra Dun. To reduce all air dry strength values to a uniform moisture content of 12 per cent. To do any special tests required in this connection.	
	SEASONING SECTION.	
23	*Natural seasoning.*—To continue experiments on natural seasoning with special reference to the methods of stacking and protecting timber in (*i*) moist and (*ii*) dry climatic conditions, and to investigate preliminary water soaking prior to seasoning— (*i*) The practice of stacking small quantities of any material left over from Project VII experiments (item 40) for observations of the air seasoning characteristics of the species will be continued. (*ii*) Water soaking tests on the following species will be continued:— *i. Terminalia tomentosa.* *ii.* „ *paniculata.* *iii. Quercus lineata.* *iv.* „ *lamellosa.* *v. Hopea parviflora.* *vi. Eugenia gardneri.* *vii. Anogeissus latifolia.* *viii. Amoora wallichii.*	
24	*Seasoning of sleepers.*—To continue experiments on the seasoning of sleepers and other forms of sawn timber to prevent splitting, warping and other forms of depreciation. (Further field experiments will be undertaken, as and when required).	

Serial No.	Proposals.	Explanatory remarks.
25	*Project VII.*—To continue experiments under Project VII to determine the maximum temperatures and minimum humidities which will accomplish the seasoning of the more important Indian woods in the shortest time possible without impairing the physical and mechanical properties of the timber. (*i*) Experiments on the new process will be continued and when some more experience has been gained, a kiln drying hand-book will be published. (*ii*) The following species are required for further trial during the triennium. *Adina cordifolia* from United Provinces and Central Provinces. *Dalbergia sissoo* from United Provinces. *Dipterocarpus alatus* or *turbinatus* from Andamans. *Cedrus deodara* from the Punjab. *Lagerstræmia lanceolata* from Bombay. *Tectona grandis* from Central Provinces. *Dichopsis polyantha* from Bengal. *Lagerstræmia lanceolata* from Madras. One timber from Assam. Any one of the following :— Hollong, hollock, jarul or cham (at the discretion of the Forest Economist). NOTE.—The species are the same as mentioned in the last triennial programme. (*iii*) Two more kilns are to be built and small scale tests will be continued.	
26	*Types of seasoning kilns.*—To study the working of different types of seasoning kilns, with special reference to circulation, temperature and humidity control. (A new internal fan kiln is under construction and modifications to old kilns are being constantly made to improve the kiln design.)	
27	*Vacuum drying.*—To undertake small experiments on drying timber in a vacuum.	
28	*Cost of kiln drying.*—To determine the cost of kiln drying from results obtained at Dehra Dun and elsewhere.	
29	*Furnace kiln.*—To carry out experiments on drying timbers in a furnace kiln, in which furnace gases are used directly for evaporating moisture from the wood : (*i*) Further tests will be carried out when any timber is available for kiln drying. (*ii*) A kiln will be erected for indirect heating by furnace gases, which will avoid discolouration of wood due to smoke, will be cheaper to instal, and will require less supervision to operate.	

Serial No.	Proposals.	Explanatory remarks.
30	*Fundamental factors of seasoning.*—To make special study of the fundamental factors affecting the natural, as well as the artificial drying of wood. This will include investigations on— (*i*) the movement of moisture in wood. (*ii*) the stresses in wood during drying. (*iii*) the moisture equilibrium of wood at various humidities.	
31	*Study of physical properties.*—To continue the special study of the various physical properties of wood, *viz.*— (*i*) Shrinkage. (*ii*) Density. (*iii*) Electric resistance. (*iv*) Heat conductivity. (*v*) Effect of chemical compounds in wood on moisture content.	
32	*Steam bending.*—To study the steam bending of wood in co-operation with the Wood-Working Section.	
	WOOD PRESERVATION SECTION.	
33	Design of buildings for warding off termite attack of timber, and the erection of a model house illustrating the principles involved.	
34	*Treatment of spruce and fir.*—To continue work on the treatment of spruce and fir sleepers, in order to devise a better method of treating these woods.	
35	*Investigation on arsenicals.*—To continue the investigation on the relative value of arsenicals and copper compounds as wood preservatives, with special reference to Falkamesam, zinc-meta-arsenite, arsenic pentoxide, etc., (Ascu being substituted for Falkamesam.)	
36	*Falkamesam process.*—To determine the optimum conditions of treatment of various woods, using the Falkamesam process. (Ascu being substituted for Falkamesam).	
37	*Treatment for special properties.*—To investigate the treatment of timber for obtaining special properties.	
38	*Viscosity and penetration.*—To investigate the relation between viscosity and penetration into wood of— (*a*) oil preservatives. (*b*) water soluble preservatives.	
39	*Prevention of splitting.*—To investigate the relative effect and economy of asphaltic, bituminous, or similar compounds in wood preservation, to protect wood from splitting.	

Serial No.	Proposals.	Explanatory remarks.
40	Fireproofing of wood, development and testing of special fire-retardant paints for superficial application, and chemicals for injection into wood.	
41	Development of a combined antiseptic and fireproofing treatment especially in conjunction with Ascu.	
42	Development of special methods for treating timber poles and posts *in situ*.	
43	Treatment of the heartwood of the more refractory Indian timbers by incision method.	
44	Investigation into the possibilities for the use of treated indigenous timbers in marine construction.	
45	Propaganda for the extensive use of artificially preserved wood for electrical poles, cross-arms, cross-arm braces, struts, etc., fence posts, building construction, bridges, etc.	
46	Inauguration of extensive service tests with Ascu-treated bamboo mats and partitions, wood electrical poles, fence posts, boats, bridges, building timber and marine piling.	
	PAPER PULP SECTION.	
47	*Utilisation of bamboos for Pulp and Paper*— (1) Chemical and microscopical examination consisting of (*a*) the quantitative determination of the principal chemical constituents and (*b*) the structure and dimensions of the ultimate fibres of the following species of bamboos— (*a*) *Ochlandra brandisii*. (*b*) *Melocanna bambusoides*. (*c*) *Dendrocalamus strictus*. (*d*) *Bambusa arundinacea*. (*e*) *Dendrocalamus hamiltonii*. (2) Evacuation, by standard methods, of the physical and chemical properties of the soda and sulphate pulps, prepared under standard conditions, from the five species of bamboos mentioned above. (3) Preparation and purification of pulp suitable for use in the artificial silk industry. (4) Mechanical disintegration of bamboos and liquor penetration studies on chips of different sizes, to determine the optimum size of chips for economic digestion. (5) Preparation of mechanical or semi-chemical pulp from bamboos for the production of cheap qualities of papers.	

Serial No.	Proposals.	Explanatory remarks.
48	*Utilisation of grasses for Pulp and Paper*— (1) Chemical and microscopical examination, consisting of (*a*) the determination of the principal chemical constituents and (*b*) the structure and dimensions of the ultimate fibres, of the following :— (*a*) *Anthistiria gigantea.* (*b*) *Saccharum spontaneum.* (*c*) *Ischœmum angustifolium.* (2) Evaluation by standard methods, of the physical and chemical properties of the soda and sulphate pulps, prepared under standard conditions from :— (*a*) *Ischœmum angustifolium* from different areas. (*b*) *Anthistiria gigantea.* (*c*) *Saccharum spontaneum.* (3) Preparation and purification of pulps from (*a*) *Ischœmum angustifolium* and (*b*) *Anthistiria gigantea* for use in the artificial silk industry. (4) Examination of forest grasses for pulp and paper making, as and when required.	
49	Investigation to turn lantana into a useful economic product for the manufacture of— (*a*) paper pulp of any kind, and (*b*) baskets for packing fruits and other purposes from branches.	
50	*Utilization of wood for Pulp and Paper*— (1) Chemical and microscopical examination of *Pinus longifolia*, consisting of (*a*) the determination of the principal chemical constituents and (*b*) the structure and dimensions of the ultimate fibres. (2) Evaluation, by standard methods of the physical and chemical properties of the soda and sulphate pulps prepared under standard conditions from *Pinus longifolia* from the United Provinces Forest Divisions. (3) Production of mechanical pulp from *Pinus longifolia* for the production of cheap papers.	
51	Co-operative research, with Paper Mills, on problems of immediate industrial importance, as required from time to time.	
52	Compilation of the following available data about the principal and important species of bamboos and grasses— (*a*) extent of the forest areas and the supplies available, and (*b*) Information regarding growth, felling rotation and flowering of bamboos.	

Serial No.	Proposals.	Explanatory remarks.
	WOOD WORKSHOP SECTION.	
*53	*Veneers, Plywood and Glues—* To continue work under Project VIII as follows :— (*a*) Timbers for investigation as suggested in Project VIII are :— *Eriolæna candollei.* *Hopea odorata.* *Melanorrhœa usitata.* *Parashorea stellata.* *Terminalia manii.* *Alstonia scholaris.* *Altingia excelsa.* *Carapa moluccensis.* *Dillenia pentagyna.* *Lophopetalum fimbriatum.* *Morus lævigata.* *Nyssa* spp. *Parishia insignis.* *Saccopetalum tomentosum.* *Sideroxylon longepetiolatum.* *Sterculia alata.* *Swintonia* spp. *Talauma phellocarpa.* *Terminalia arjuna.* ,, *procera.* *Vatica lanceæfolia.* *Boswellia serrata.* *Cedrela* spp. *Vitex penduncularis.* *Cedrus deodara.* *Cupressus* spp. *Dipterocarpus pilosus.* *Kydia calycina.* *Magnifera* spp. *Pinus longifolia.* *Shorea assamica.* *Sterculia campanulata.* *Holoptelia integrifolia.* (*b*) Tests on glues, as and when required. On behalf of inquirers glue tests will be carried out in conjunction with the species chosen.	
54	To observe the working qualities of various Indian timbers for purposes such as furniture, cabinet making, tool handles, packing cases, interior fittings and sporting requisites, etc., etc., for which at present imported timbers are largely used. (Tests on working qualities of timbers will be carried out as material comes to hand from the Timber Testing Section and outside inquirers.)	

BIOCHEMICAL BRANCH.

Serial No.	Proposals.	Explanatory remarks.
	A.—Fats and Oils.	
1	*Bauhinia* species	A chemical study of the fatty oil would be of value as the seeds are said to contain 30 per cent of a non-drying edible and medicinal oil. Common in Dehra Dun and Tons valleys.
2	*Prinsepia utilis*	The oil from the seeds is chiefly used for burning and it would be interesting to study its chemistry with a view to finding wider application for it. Common in Jaunsar, United Provinces.
3	*Solanum indicum*	A few foreign varieties of this species are said to yield a strongly drying oil. A chemical study of the oil might lead to its commercial exploitation. Common in Dehra Dun and Saharanpur districts.
4	*Litsæa* species	A chemical study of the fats of this species was undertaken to find their lauric acid content. They are important raw material for the preparation of lauric acid and its products. (Dehra Dun and Chakrata.)
5	*Eupatorium odoratum*	The essential oil for test.
6	*Lantana camara.*	
7	*Castanopsis.*	

Serial No.	Proposals.	Explanatory remarks.
8	*Beilschmiedia brandisii*	(Its bark is used by hill tribes in the Sadiya Frontier Tracts for chest complaints).
	B.—Drugs.	
9	*Vitex peduncularis*	This plant is reputed to be a febrifuge in certain parts of India. The chemical examination of its constituents and the isolation of its active principle is already in hand. Approved by Assam. Throughout India Bihar and Bengal.
10	*Derris* sp. (*a*) *Derris elliptica*	*Derris elliptica* which occurs in certain localities in Assam has been found to contain rotenone. Approved by Assam.
11	(*b*) *Derris robusta*	Although it did not yield any rotenone it was found to contain some crystalline substances. It is proposed to examine these substances. (Assam.)
12	Fish poisons and insecticides	Many Indian plants are known to be fish poisons, it is proposed to examine these with a view to their application as insecticides.
13	*Urena lobata*	Analysis of root.
	List of Fish Poisons.	
	(1) *Antiaris toxicaria* Lesch. Urticaceæ. (2) *Barringtonia acutangula* Gærtn. and *B. speciosa* Forst. . . . Myrtaceæ. (3) *Cannabis sativa* Linn . Urticaceæ. (4) *Casearis graveolens* Dalz. and *C. tomentosa* Roxb. . Samydaceæ. (5) *Cleistanthus collinus* Benth . . . . Euphorbiaceæ.	

Serial No.	Proposals.		Explanatory remarks.
	(6) *Corypha umbraculifera* Linn.	Palmeæ.	
	(7) *Cyclamen persicum* Miller	Primulaceæ.	
	(8) *Diospyros paniculata* Dalz.	Ebenaceæ.	
	(9) *Dolichandrone falcata* Seem.	Bignoniaceæ.	
	(10) *Entada scandens* Benth.	Leguminosæ.	
	(11) *Eremostachys vicaryi* Benth. . . .	Labiatæ.	
	(12) *Euphorbia tirucalli* Linn.	Euphorbiaceæ.	
	(13) *Flueggea leucopyrus* Wight. and *F. microcarpa* Blume. . .	Euphorbiaceæ.	
	(14) *Lasiosiphon eriocephalus* Done.	Thymelaceæ.	
	(15) *Maesa indica* Wall .	Myrsineæ.	
	(16) *Millettia atropurpurea* Benth and *M. pachycarpa* Benth . .	Leguminosæ.	
	(17) *Mundulea suberosa* Benth. . . .	Leguminosæ.	
	(18) *Myrica nagi* Thunb .	Myricaceæ.	
	(19) *Ougeinia dalbergioides* Benth	Leguminosæ.	
	(20) *Pithecolobium bigeminum* Benth. . . .	Leguminosæ.	
	(21) *Pandia dumetorum* Lam.	Rubiaceæ.	
	(22) *Rhododendron barbatum* Wall	Ericaceæ.	
	(23) *Sapium indicum* Willd.	Euphorbiaceæ.	
	(24) *Trichilia trifoliata* Roxb.	Meliaceæ.	
	(25) *Verbascum thapsus* Linn.	Scrophularineæ.	
	(26) *Walsura piscidia* Roxb.	Meliaceæ.	
	(27) *Zanthoxylum alatum* Roxb.	Rutaceæ.	
14	*Homalium rubescens*		Analysis of the root of *gandhi*.

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